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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for E-UTRA Relay. These have been derived from, and are consistent with the E-UTRA Relay specifications defined in [2].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.116: "Evolved Universal Terrestrial Radio Access (E-UTRA); Relay radio transmission and reception".

[3] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) Conformance Testing (Release 11)".

[4] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) Radio Transmission and Reception (Release 11)".

[5] 3GPP TR 36.826: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) Relay Radio Transmission and Reception".

[6] 3GPP TS 36.101: "User Equipment (UE) radio transmission and reception".

[7] 3GPP TS 36.521-1 "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[8] 3GPP TS 36.508 "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing".

[9] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation".

[10] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[11] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

access link: Link for communication between Relay and UE.

backhaul link: Link for communication between Relay and BS.

carrier: The modulated waveform conveying the E-UTRA or UTRA physical channels

channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

channel edge: The lowest and highest frequency of the E-UTRA carrier, separated by the channel bandwidth.

in-band relay: A Relay where the access link and backhaul link operates in the same operating band.

measurement bandwidth: The bandwidth in which an emission level is specified.

occupied bandwidth: The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission.

RRC filtered mean power: The mean power of a UTRA carrier as measured through a root raised cosine filter with roll-off factor α and a bandwidth equal to the chip rate of the radio access mode.

NOTE: The RRC filtered mean power of a perfectly modulated UTRA signal is 0.246 dB lower than the mean power of the same signal.

transmission bandwidth: Bandwidth of an instantaneous transmission from a UE or BS, measured in Resource Block units.

transmission bandwidth configuration: The highest transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Pout	Output Power
Pmax	Maximum total output power

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ACLR	Adjacent Channel Leakage Ratio
ACK	Acknowledgement (in HARQ protocols)
ACS	Adjacent Channel Selectivity
AWGN	Additive White Gaussian Noise
BS	Base Station
CP	Cyclic prefix
CRC	Cyclic Redundancy Check
CW	Continuous Wave
DC	Direct Current
DFT	Discrete Fourier Transformation
DTX	Discontinuous Transmission
DUT	Device Under Test
DwPTS	Downlink part of the special subframe (for TDD operation)
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EPA	Extended Pedestrian A model
ETU	Extended Typical Urban model
E-UTRA	Evolved UTRA
EVA	Extended Vehicular A model
EVM	Error Vector Magnitude

FDD	Frequency Division Duplex
FFT	Fast Fourier Transformation
FRC	Fixed Reference Channel
GP	Guard Period (for TDD operation)
HARQ	Hybrid Automatic Repeat Request
HD-FDD	Half- Duplex FDD
ICS	In-Channel Selectivity
ITU-R	Radiocommunication Sector of the ITU
LA	Local Area
MCS	Modulation and Coding Scheme
MCL	Minimum Coupling Loss
OFDM	Orthogonal Frequency Division Multiplex
OOB	Out-of-band
PA	Power Amplifier
PBCH	Physical Broadcast Channel
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PUSCH	Physical Uplink Shared Channel
PUCCH	Physical Uplink Control Channel
PRACH	Physical Random Access Channel
PRAT	Rated output power
PSS	Primary Synchronization Signal
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
RAT	Radio Access Technology
RB	Resource Block
RE	Resource Element
REFSENS	Reference Sensitivity power level
RF	Radio Frequency
RMS	Root Mean Square (value)
R-PDCCH	Relay Physical Downlink Control Channel
RS	Reference Symbol
RX	Receiver
RRC	Root Raised Cosine
SNR	Signal-to-Noise Ratio
SSS	Secondary Synchronization Signal
TA	Timing Advance
TDD	Time Division Duplex
TX	Transmitter
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
WA	Wide Area

4. General test conditions and declarations

Many of the tests in this specification measure a parameter relative to a value that is not fully specified in the E-UTRA specifications. For these tests, the Minimum Requirement is determined relative to a nominal value specified by the manufacturer.

Certain functions of a relay are optional in the E-UTRA specifications. Furthermore some requirements for the relay may be regional as listed in clause 4.3.

When specified in a test, the manufacturer shall declare the nominal value of a parameter, or whether an option is supported.

4.1 Measurement uncertainties and Test Requirements

4.1.1 General

The requirements of this clause apply to all applicable tests in the present document.

The Minimum Requirements are given in 36.116 [2] except that they apply to a relay node and test requirements are given in this specification. Test Tolerances are defined in Annex G of TS 36.141 [3]. Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum Requirements in TS 36.116 [2] to create Test Requirements.

4.1.2 Acceptable uncertainty of Test System

The maximum acceptable uncertainty of the Test System is specified below for each test, where appropriate. The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance and the equipment under test to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95%, unless otherwise stated.

A confidence level of 95% is the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment.

For RF tests, it should be noted that the uncertainties in clause 4.1.2 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

4.1.2.1 Measurement of relay access transmitter

The maximum test system uncertainty for relay access transmitter test shall be as defined in Table 4.1.2.1 of TS 36.141 [3] except that the requirements apply to relay nodes.

4.1.2.2 Measurement of relay access receiver

The maximum test system uncertainty for relay access receiver tests shall be as defined in Table 4.1.2.2 of TS 36.141 [3] except that the requirements apply to relay nodes.

4.1.2.3 Measurement of performance requirement

The maximum test system uncertainty for relay access performance requirements shall be as defined in Table 4.1.2.3 of TS 36.141 [3] except that the requirements apply to relay nodes.

4.2 Relay classes

The Relay classes are defined based on the RF scenarios expected for the Relay access deployment, defined in terms of the Minimum Coupling Loss (MCL) between Relay and UE. The following definitions are used:

- High-CL Relay are characterised by requirements derived from outdoor Relay scenarios with a Relay to UE minimum coupling loss equals to 59 dB

- Low-CL Relay are characterised by requirements derived from indoor Relay scenarios with a Relay to UE minimum coupling loss equals to 45 dB

4.3 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements or set by local and regional regulation as mandatory requirements. It is normally not stated in the 3GPP specifications under what exact circumstances that the requirements apply, since this is defined by local or regional regulation.

Table 4.3-1 of 36.141 [3] lists all the requirements that may be applied differently to relay nodes in different regions.

4.4 Selection of configurations for testing

The requirements for selection of configurations for testing shall be the same as in clauses 4.4 and 4.5 of TS 36.141 [3] except that the requirements shall apply to relay nodes.

4.5 Manufacturer's declarations of regional and optional requirements

The requirements for manufacturer's declarations of regional and optional requirements shall be the same as in clause 4.6 of TS 36.141 [3] except that the requirements shall apply to relay nodes.

4.6 Specified frequency range and supported channel bandwidth

The requirements for specified frequency range and supported channel bandwidth requirements shall be the same as in clause 4.6 of TS 36.141 [3] except that the requirements shall apply to relay nodes.

4.7 Format and interpretation of tests

Each test in the following clauses has a standard format:

X Title

All tests are applicable to all equipment within the scope of the present document, unless otherwise stated.

X.1 Definition and applicability

This subclause gives the general definition of the parameter under consideration and specifies whether the test is applicable to all equipment or only to a certain subset. Required manufacturer declarations may be included here.

X.2 Minimum Requirement

This subclause contains the reference to the subclause to the 3GPP reference (or core) specification which defines the Minimum Requirement.

X.3 Test Purpose

This subclause defines the purpose of the test.

X.4 Method of test

X.4.1 Initial conditions

This subclause defines the initial conditions for each test, including the test environment, the RF channels to be tested and the basic measurement set-up.

X.4.2 Procedure

This subclause describes the steps necessary to perform the test and provides further details of the test definition like point of access (e.g. test port), domain (e.g. frequency-span), range, weighting (e.g. bandwidth), and algorithms (e.g. averaging).

X.5 Test Requirement

This subclause defines the pass/fail criteria for the equipment under test. See subclause 4.1.2.5 Interpretation of measurement results.

5 Operating bands and Channel arrangement

5.1 General

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

NOTE: Other operating bands and channel bandwidths may be considered in future releases.

5.2 Operating bands

E-UTRA is designed to operate in the operating bands defined in Table 5.5-1 of TS 36.104 [4].

5.3 Channel bandwidth

Requirements in the present document are specified for the channel bandwidths listed in Table 5.6-1 of TS 36.104 [4].

For the access link the manufacturer shall declare the channel bandwidths supported by the Relay.

For the backhaul link the Relay shall support the channel bandwidths denoted by "Yes" in Table 5.6.1-1 of TS 36.101 [6] for the supported operating band. Note 1 in Table 5.6.1-1 does not apply.

5.4 Channel arrangement

The channel spacing is specified in clause 5.7.1 of TS 36.104 [4].

The channel raster is specified in clause 5.7.2 of TS 36.104 [4].

Carrier frequency and EARFCN is specified in clause 5.7.3 of TS 36.104 [4].

6. Transmitter characteristics

6.1 General

General test conditions for transmitter tests are given in clause 4, including interpretation of measurement results and configurations for testing. Test configurations are defined in clause 4.5 of TS 36.141 [3] except that they apply to relays, while Annex H of TS 36.141 [3] provides an informative description of E-UTRAN test cases.

6.1.1 E-UTRA Test Models

The set-up of physical channels for the access transmitter tests shall be according to one of the E-UTRA test models (E-TM) defined in clause 6.1.1 of TS 36.141 [3] except that they apply to relay nodes.

The set-up of physical channels for the backhaul transmitter tests shall be according to one of the E-UTRA test models (E-TM) defined in clause 4.1 of TS 36.508 [8] except that they apply to relay nodes. The following reference test conditions shall apply

Test Environment: Normal, as defined in TS 36.508 [8] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [8] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [8] clause 4.3.1.1.

6.2 Output power

6.2.1 Definition and applicability

Output power, Pout, of the relay is the mean power of one carrier delivered to a load with resistance equal to the nominal load impedance of the transmitter.

The maximum total output power (Pmax), of the relay is the mean power level measured at the antenna connector during the transmitter ON period in a specified reference condition.

Rated total output power of the relay is the mean power for relay operating in single carrier or multiple carrier configurations that the manufacturer has declared to be available at the antenna connector during the transmitter ON period.

Relay maximum output power (Pmax, c), of the relay is the mean power level per carrier measured at the antenna connector during the transmitter ON period in a specified reference condition.

The rated output power is the mean power level that the manufacturer has declared to be available at the antenna connector during the transmitter ON period.

NOTE: Different PRATs may be declared for different configurations

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the ranges defined for the Normal test environment in Annex D of TS 36.141 [3].

The rated output power shall be as specified in table 6.2.1-1.

Table 6.2.1-1 Relay Rated Output Power

Relay power class	Access link rated output power [dBm]	Backhaul link rated output power [dBm]
Power class 1	< +24 (for one transmit antenna port) < +21 (for two transmit antenna ports) < +18 (for four transmit antenna ports) < +15 (for eight transmit antenna ports)	< +24 (for one transmit antenna port) < +21 (for two transmit antenna ports) < +18 (for four transmit antenna ports)
Power class 2	< +30 (for one transmit antenna port) < +27 (for two transmit antenna ports) < +24 (for four transmit antenna ports) < +21 (for eight transmit antenna ports)	< +24 (for one transmit antenna port) < +21 (for two transmit antenna ports) < +18 (for four transmit antenna ports)

NOTE: For coexistence with a victim base station a minimum MCL should be met in all scenarios. This is particularly relevant for use cases where Relays are placed wall mounted or in rooftops. The value for this MCL is 45 dB.

6.2.2 Minimum Requirement

The minimum requirement is defined in TS 36.116 [2] clause 6.2.1.1.

6.2.3 Test purpose

The test purpose is to verify the accuracy of the maximum output power across the frequency range and under normal and extreme conditions for all transmitters in the relay node.

6.2.4 Method of test

The requirements for method of test for the relay access link maximum output power shall be the same as in clause 6.2.4 of TS 36.141 [3] except that the requirements shall apply to relay nodes.

The requirements for method of test for the relay backhaul link maximum output power shall be the same as in clause 6.2.2.4 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.2.5 Test Requirements

Test Requirements for the relay access link shall be the same as defined in Table 6.2.5-1

Table 6.2.5-1 Relay Rated output power

Relay power class	PRAT	Minimum requirement Tolerance in TS 36.116 [dB] for normal conditions	Test requirements in TS 36.117 [dB] Tolerance [dB] for extreme conditions
Power class 1	< + 24 dBm (for one transmit antenna port) < + 21 dBm (for two transmit antenna ports) < + 18 dBm (for four transmit antenna ports) < + 15 dBm (for eight transmit antenna ports)	In normal conditions: within ±2 dB of manufacturer's rated output power In extreme conditions: within ±2.5 dB of manufacturer's rated output power±2 of rated output power declared by manufacturer	In normal conditions: within +2.7 dB and -2.7 dB of the manufacturer's rated output power, f ≤ 3.0GHz; within +3.0 dB and -3.0 dB of the manufacturer's rated output power, 3.0 GHz < f ≤ 4.2 GHz In extreme conditions: within +3.2 dB and -3.2 dB of the manufacturer's rated output power, f ≤ 3.0 GHz within +3.5 dB and -3.5 dB of the manufacturer's rated output power, 3.0 GHz < f ≤ 4.2 GHz ±2.5 of rated output power declared by manufacturer
Power class 2	< + 30 dBm (for one transmit antenna port) < +27 dBm (for two transmit antenna ports) < + 24dBm (for four transmit antenna ports) * < + 21dBm (for eight transmit antenna ports)*	In normal conditions: within ±2 dB of manufacturer's rated output power In extreme conditions: within ±2.5 dB of manufacturer's rated output power±2 of rated output power declared by manufacturer	In normal conditions: within +2.7 dB and -2.7 dB of the manufacturer's rated output power, f ≤ 3.0 GHz within +3.0 dB and -3.0 dB of the manufacturer's rated output power, 3.0 GHz < f ≤ 4.2 GHz In extreme conditions: within +3.2 dB and -3.2 dB of the manufacturer's rated output power, f ≤ 3.0 GHz within +3.5 dB and -3.5 dB of the manufacturer's rated output power, 3.0 GHz < f ≤ 4.2 GHz ±2.5 of rated output power declared by manufacturer

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

For the backhaul link the minimum test requirements of Power Class 1 in Table 6.2.5-1 shall apply.

6.2.6 Configured transmitted Power for backhaul link

The Relay backhaul link is allowed to set its configured maximum output power P_{CMAX}. The configured maximum output power P_{CMAX} is set within the following bounds:

- P_{CMAX} = MIN { P_{EMAX}, PRAT }.
- P_{EMAX} is the value given to IE *P-Max*, defined in TS 36.331.
- PRAT is the Relay rated output power specified in table 6.2.1-1 without taking into account the tolerance specified in the table 6.2.2.1-1 of TS 36.116 [2].

. The minimum requirement is defined in TS 36.116 [2], clause 6.2.2.1.

The requirements for method of test for the relay backhaul link maximum output power shall be the same as in clause 6.2.5 of TS 36.521 [7] except that the requirements shall apply to relay nodes and the reference measurement channel for R-PDCCH defined in Annex B of TS 36.116 [2] shall apply for R-PDCCH .

6.3 Output power dynamics

6.3.1 Access Link Test Requirements.

6.3.1.1 RE Power control dynamic range

The RE Power control dynamic range test requirements for the relay access link shall be the same as in clause 6.3.1 of TS 36.141[3] except that the requirements apply to relay nodes.

6.3.1.2 Total power dynamic range

The total power dynamic range test requirements for the relay access link shall be the same as in clause 6.3.2 of TS 36.141 [3] except that the requirements apply to relay nodes.

6.3.1.3 Transmitter OFF power

The transmitter off power for Relay access link should be applied the same requirement defined in clause 6.4.1 of TS 36.141 [3].

6.3.1.4 Transmitter transient period

The transmitter transient period for Relay access link should be applied the same requirement defined in clause 6.4.2 of TS 36.141 [3].

6.3.2 Backhaul Link Test Requirements

For backhaul link test the configuration of OFDM symbols for eNB-to-RN transmission in the first slot shall be as specified in Table 5.4-1 in TS 36.216. Furthermore the reference measurement channel for R-PDCCH defined in Annex B of TS 36.116 [2] shall apply.

6.3.2.1 Minimum Output Power

6.3.2.1.1 Test purpose

To verify the relay nodes ability to transmit with a broadband output power below the value specified in the test requirement when the power is set to a minimum value.

6.3.2.1.2 Test applicability

This test applies to all types of E-UTRA relay nodes.

6.3.2.1.3 Minimum conformance requirements

For a Relay backhaul link with one antenna connector the minimum output power shall not exceed -50 dBm.

For a relay backhaul link with multiple transmit antenna connectors, the minimum output power level is defined with respect to the sum of the mean power at each relay node backhaul antenna connector in one sub-frame (1 ms). The sum of these mean powers will be subject to the -50 dBm minimum output power requirement.

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.3-1.

Table 6.3.2.3-1: Minimum output power

	Channel bandwidth / minimum output power / measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	-50 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

The minimum output power test verifies the relay node's ability to transmit with a broadband output power below the specified limit when the power is set to a minimum value. The broadband output power is defined as the power in the channel bandwidth, for all transmit bandwidth configurations (resource blocks).

6.3.2.1.4 Test description

The requirements for method of test shall be the same as in clause 6.3.2.4 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.1.5 Test Requirement

The minimum output power measured shall not exceed the values specified in Table 6.3.2.5-1.

Table 6.3.2.1.5-1: Minimum output power

	Channel bandwidth / minimum output power / measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	For carrier frequency f ≤ 3.0 GHz: ≤ [-49] dBm For carrier frequency 3.0 GHz < f ≤ 4.2 GHz: ≤ [-48.7] dBm					
Measurement bandwidth (see note)	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz
NOTE: Different implementations such as FFT or spectrum analyzer approach are allowed. For spectrum analyzer approach the measurement bandwidth is defined as an equivalent noise bandwidth.						

The requirements in clause 6.3.2.1 apply during the transmitter ON period. Transmit signal quality (as specified in clause 6.4 of TS 36.116 [2] specific to the relay backhaul link signal quality) shall be maintained for the output power dynamics requirements of this clause.

6.3.2.2 Power Control Absolute power tolerance

The relay backhaul link test requirements for power control absolute power tolerance shall be the same as in clause 6.3.5.1 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.3 Power Control Relative power tolerance

The relay backhaul link test requirements for power control relative power tolerance shall be the same as in clause 6.3.5.2 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.4 Aggregate power control tolerance

The relay backhaul link test requirements for aggregate power control tolerance shall be the same as in clause 6.3.5.3 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.5 Power Control for UL-MIMO

The relay backhaul link test requirements for power control for UL-MIMO shall be the same as in clause 6.3.5B of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.6 Transmit ON/OFF Time Mask

With the exception of requirements for PRACH all the other requirements defined in clause 6.3.4 of TS 36.101 shall be applied for Relay backhaul link as transmitter ON/OFF time mask. The off power for Relay backhaul link is defined in clause 8.1.3.2.

For a relay backhaul link with multiple transmit antenna connectors, the requirement defined in clause 6.3.4B of TS 36.101 shall be applied, besides the requirements for PRACH.

For the relay backhaul link the transmit ON/OFF time mask test requirements shall be the same as in clause 6.3.4 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.3.2.7 Transmit OFF Power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the Relay backhaul is not allowed to transmit or during periods when the Relay is not transmitting a sub-frame. During DTX and measurements gaps, the Relay backhaul is not considered to be OFF.

6.3.2.7.1 Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.2.7.1-1.

Table 6.3.2.7.1-1: Transmit OFF power

	Channel bandwidth / Transmit OFF power / measurement bandwidth					
	1.4 MHz	**3.0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
Transmit OFF power	-66 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

The relay backhaul link transmit OFF power test requirements shall be the same as in clause 6.3.3 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.4 Transmitted signal quality

6.4.1 Frequency error

6.4.1.1 Definition and applicability

Frequency error is the measure of the difference between the actual relay transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

It is not possible to verify by testing that the data clock is derived from the same frequency source as used for RF generation. This may be confirmed by the manufacturer's declaration.

6.4.1.2 Minimum Requirement

The minimum requirement is in TS 36.116 [2], clause 6.4.1.1.

6.4.1.3 Test purpose

To verify that the Frequency Error is within the limits of the minimum requirement.

6.4.1.4 Method of test

For the relay access link, the frequency error requirement is tested together with the Error Vector Magnitude test, as described in clause 6.5.2 of TS 36.141 [3] except that the requirements apply to relay nodes.

For the relay backhaul link, the frequency error test method shall be the same as in clause 6.5.1.4 of TS 36.521 [7] except that the requirements shall apply to relay nodes.

6.4.1.5 Test requirement

For the relay access link, the modulated carrier frequency of each E-UTRA carrier configured by the relay shall be accurate to within an accuracy of ± (0.1 ppm + 12 Hz) observed over a period of one subframe (1ms).

For the relay backhaul link the frequency error Δf results must fulfill the test requirement: $|\Delta f| \leq (0.1\ \text{PPM} + 15\ \text{Hz})$

NOTE: If the above Test Requirement differs from the Minimum Requirement then the Test Tolerance applied for this test is non-zero. The Test Tolerance for this test and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance are given in Annex G of TS 36.141 [3].

6.4.2 EVM

The EVM test requirements for the relay access link shall be the same as in clause 6.5.2 of TS 36.141 [3] except that the requirements apply to relay nodes.

The EVM test requirements for the relay backhaul link shall be the same as in clause 6.5.2 of TS 36.521 [7] except that the requirements apply to relay nodes

6.4.3 Time alignment between different branches

The test requirements for time alignment between different branches for the relay access link shall be the same as in clause 6.5.3 of TS 36.141 [3] except that the requirements apply to relay nodes.

The test requirements time alignment between different branches for the relay backhaul link shall be the same as in clause 6.8 of TS 36.521 [7] except that the requirements apply to relay nodes

6.4.4 DL RS power

The DL RS power test requirements for the relay access link shall be the same as in clause 6.5.4 of TS 36.141 [3] except that the requirements apply to relay nodes.

6.5 Unwanted emissions

Unwanted emissions consist of out-of-band emissions and spurious emissions [4]. Out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The out-of-band emissions requirement for the BS transmitter is specified in terms of an Operating band unwanted emissions requirement that defines limits for emissions in the downlink operating band plus the frequency ranges 10

MHz above and 10 MHz below the band. Emissions outside of this frequency range are limited by a spurious emissions requirement.

6.5.1 Transmitter spurious emissions

The access link minimum requirement for transmitter spurious emissions is defined in TS 36.116 [2] clause 6.5.1.

The test requirements for transmitter spurious emissions for the relay access link shall be the same as in clause 6.6.4 of TS 36.141 [3] except that the requirements apply to relay nodes.

The backhaul link minimum requirement for transmitter spurious emissions is defined in TS 36.101 clause 6.6.3.1.

The test requirements for transmitter spurious emissions for the relay backhaul link shall be the same as in clause 6.6.3.1 of TS 36.521 [7] except that the requirements apply to relay nodes.

6.5.2 Adjacent Channel Leakage power Ratio (ACLR)

The access link and backhaul link minimum requirement ACLR is defined in TS 36.116 [2] clause 6.5.2.

The adjacent channel leakage power ratio (ACLR) test requirements for the relay access link shall be the same as in clause 6.6.2 of TS 36.141 [3] except that the requirements apply to relay nodes.

The adjacent channel leakage power ratio (ACLR) test requirements for the relay backhaul link shall be the same as in clause 6.6.2.3 of TS 36.521 [7] except that the requirements apply to relay nodes.

6.5.3 Operating Bands Unwanted Emissions

6.5.3.1 Definition and applicability

Unless otherwise stated, the Operating band unwanted emission limits are defined from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the downlink operating band (see Table 5.5-1 of TS 36.141 [3]).

The unwanted emission limits in the part of the downlink operating band that falls in the spurious domain are consistent with ITU-R Recommendation SM.329 [9].

For the access link and backhaul link of relay nodes, the requirements of clause 6.5.3.5 shall apply (Category A and B).

The application of either Category A or Category B limits shall be the same as for Transmitter spurious emissions (Mandatory Requirements) in clause 6.6.4.5 of TS 36.141 [3].

6.5.3.2 Minimum Requirement

The minimum requirement shall be as defined in TS 36.116 [2] clause 6.5.3.

6.5.3.3 Test purpose

This test measures the emissions of the relay access link and backhaul link, close to the assigned channel bandwidth of the wanted signal, while the corresponding transmitter is in operation.

6.5.3.4 Method of test

The Operating bands unwanted emissions method of test for the relay access link shall be the same as in clause 6.6.3.4 of TS 36.141 [3] except that the requirements apply to relay nodes

The Operating bands unwanted emissions method of test for the relay backhaul link shall be the same as in clause 6.6.2.1.4 of TS 36.521 [7] except that the requirements apply to relay nodes.

6.5.3.5 Test Requirement

The measurement results shall not exceed the maximum levels specified in the tables below, where:

- Δf is the separation between the channel edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.
- f_offset is the separation between the channel edge frequency and the centre of the measuring filter.
- f_offset_{max} is the offset to the frequency 10 MHz outside the downlink operating band.
- Δf_{max} is equal to f_offset_{max} minus half of the bandwidth of the measuring filter.

Table 6.5.3.5-1: Relay operating band unwanted emission limits for 1.4 MHz channel bandwidth (E-UTRA bands ≤ 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 1.4 MHz	1.4 MHz ≤ Δf < 2.8 MHz	2.8 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 1.45 MHz	1.45 MHz ≤ f_offset < 2.85 MHz	2.85 MHz ≤ f_offset < f_offset_{max}
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-19.5dBm - \frac{10}{1.4}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-29.5 dBm	-31 dBm
Minimum requirement Power class 2	$-13.5dBm - \frac{10}{1.4}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-23.5 dBm	-25 dBm

Table 6.5.3.5-2: Relay operating band unwanted emission limits for 1.4 MHz channel bandwidth (E-UTRA bands > 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 1.4 MHz	1.4 MHz ≤ Δf < 2.8 MHz	2.8 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 1.45 MHz	1.45 MHz ≤ f_offset < 2.85 MHz	2.85 MHz ≤ f_offset < f_offset_{max}
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-19.2dBm - \frac{10}{1.4}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-29.2 dBm	-31 dBm
Minimum requirement Power class 2	$-13.2dBm - \frac{10}{1.4}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-23.2 dBm	-25 dBm

Table 6.5.3.5-3: Relay operating band unwanted emission limits for 3 MHz channel bandwidth (E-UTRA bands ≤ 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 3 MHz	3 MHz ≤ Δf < 6 MHz	6 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 3.05 MHz	3.05 MHz ≤ f_offset < 6.05 MHz	6.05 MHz ≤ f_offset < f_offset_{max}
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-23.5dBm - \frac{10}{3}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-33.5 dBm	-35 dBm
Minimum requirement Power class 2	$-17.5dBm - \frac{10}{3}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-27.5 dBm	-29 dBm

Table 6.5.3.5-4: Relay operating band unwanted emission limits for 3 MHz channel bandwidth (E-UTRA bands > 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 3 MHz	3 MHz ≤ Δf < 6 MHz	6 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 3.05 MHz	3.05 MHz ≤ f_offset < 6.05 MHz	6.05 MHz ≤ f_offset < f_offset_{max}
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-23.2dBm - \frac{10}{3}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-33.2 dBm	-35 dBm
Minimum requirement Power class 2	$-17.2dBm - \frac{10}{3}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-27.2 dBm	-29 dBm

Table 6.5.3.5-5: Relay operating band unwanted emission limits for 5, 10, 15 and 20 MHz channel bandwidth (E-UTRA bands ≤ 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 5 MHz	5 MHz ≤ Δf < min(10 MHz, Δf_{max})	10 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 5.05 MHz	5.05 MHz ≤ f_offset < min(10.05 MHz,f_offset_{max})	10.05 MHz ≤ f_offset < f_offset_{max}
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-28.5dBm - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-35.5 dBm	-37 dBm (Note 2)
Minimum requirement Power class 2	$-22.5dBm - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-29.5 dBm	-31 dBm

Table 6.5.3.5-6: Relay operating band unwanted emission limits for 5, 10, 15 and 20 MHz channel bandwidth (E-UTRA bands > 3 GHz)

Parameter	Value		
Frequency offset of measurement filter -3dB point, Δf	0 MHz ≤ Δf < 5 MHz	5 MHz ≤ Δf < min(10 MHz, Δf_{max})	10 MHz ≤ Δf < Δf_{max}
Frequency offset of measurement filter centre frequency, f_offset	0.05 MHz ≤ f_offset < 5.05 MHz	5.05 MHz ≤ f_offset < min(10.05 MHz,f_offset$_{max}$)	10.05 MHz ≤ f_offset < f_offset$_{max}$
Measurement bandwidth (Note 1)	100 kHz	100 kHz	100 kHz
Minimum requirement Power class 1	$-28.2dBm - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-35.2 dBm	-37 dBm (Note 2)
Minimum requirement Power class 2	$-22.2dBm - \frac{7}{5}\left(\frac{f\_offset}{MHz} - 0.05\right)dB$	-29.2 dBm	-31 dBm

NOTE 1: As a general rule for the requirements in clause 6.5.3, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 2: The requirement is not applicable when Δf_{max} < 10 MHz.

6.6 Transmitter intermodulation

The minimum requirement for transmitter intermodulation for both the relay access and backhaul links shall be as defined in TS 36.116 [2] clause 6.6.

The test requirements for the transmitter intermodulation of the relay access link shall be the same as in clause 6.7 of TS 36.141 [3] except that the requirements apply to relay nodes.

The test requirements for the transmitter intermodulation of the relay backhaul link shall be the same as in clause 6.7 of TS 36.521 [7] except that the requirements apply to relay nodes.

7. Receiver characteristics

7.1 General

7.2 Reference sensitivity level

The reference sensitivity power level REFSENS is the minimum mean power applied to both the backhaul antenna ports at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.2.1 Backhaul link reference sensitivity

The test requirements for the relay backhaul link reference sensitivity shall be the same as in clause 7.3 of TS 36.521 [7] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.2.1 of TS 36.116 [2].

7.2.1 Access link reference sensitivity

The test requirements for the relay access link reference sensitivity shall be the same as in clause 7.2 of TS 36.141 [3] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.2.2 of TS 36.116 [2].

7.3 Dynamic range

7.3.1 Backhaul link Maximum Input Level

The test requirements for the relay backhaul link maximum input level are specified in clause 7.4 of TS 36.521 [7], except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.3.1 of TS 36.116 [2].

7.3.2 Access link Receiver Dynamic Range

The test requirements for the relay access link receiver dynamic range shall be the same as in clause 7.3 of TS 36.141 [3] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.3.2 of TS 36.116 [2]. For the test requirements, only those of Table 7.3.2 for local area of TS 36.141 [3] shall apply.

7.4 In-channel selectivity

The test requirements for the relay access link In-channel selectivity shall be the same as in clause 7.4 of TS 36.141 [3] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.4 of TS 36.116 [2]. For the test requirements, only those of Table 7.4-2 for local area of TS 36.141 [3] shall apply.

7.5 Adjacent Channel Selectivity (ACS)

7.5.1 Backhaul Adjacent Channel Selectivity (ACS)

The test requirements for the relay backhaul link ACS are specified in clause 7.5 of TS 36.521 [7], except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.5.1 of TS 36.116 [2].

7.5.2 Access Link Adjacent Channel Selectivity (ACS)

The test requirements for the relay access link ACS shall be the same as in clause 7.5 of TS 36.141 [3] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.5.2 of TS 36.116 [2]. For the test requirements, only those for local area of clause 7.5 of TS 36.141 [3] shall apply.

7.6 Blocking characteristics

7.6.1 Backhaul Blocking Characteristics

The test requirements for the relay backhaul link blocking characteristics are specified in clause 7.6 of TS 36.521 [7], except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.6.1 of TS 36.116 [2].

7.6.2 Access Link Blocking Characteristics

The test requirements for the relay access link blocking characteristics shall be the same as in clause 7.6 of TS 36.141 [3] except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.6.2 of TS 36.116 [2].

For the test requirements, only those for local area of clause 7.6 of TS 36.141 [3] shall apply.

7.6.3 Blocking requirements for co-location

The test requirements for the relay backhaul link blocking requirements for co-location shall be the same as in clause 7.6.5.2 of TS 36.141 [3] except that the requirements apply to relay nodes. For the test requirements, only those for local area of clause 7.6.5.2 of TS 36.141 [3] shall apply.

The Local Area BS requirements shall apply for the access link for relay power class 1. For relay power class 2 the interfering signal power in table 7.6-4 of TS 36.141[3] shall be changed to 0 dBm. The test requirements for the relay access link blocking requirements for co-location shall be the same as in clause 7.6.5.2 of TS 36.141 [3] except that the requirements apply to relay nodes. For the test requirements, only those for local area of clause 7.6.5.2 of TS 36.141 [3] shall apply.

7.7 Receiver spurious emissions

7.7.1 Backhaul Link Receiver Spurious Emissions

The test requirements for the relay backhaul link receiver spurious emissions are specified in clause 7.9 of TS 36.521 [7], except that the requirements apply to relay nodes.

7.7.2 Access Link Receiver Spurious Emissions

The test requirements for the relay access link receiver spurious emissions shall be the same as in clause 7.7 of TS 36.141 [3], except that the requirements apply to relay nodes.

7.8 Receiver intermodulation

7.8.1 Backhaul Link Receiver Intermodulation

The test requirements for the relay backhaul link receiver intermodulation are specified in clause 7.8 of TS 36.521 [7], except that the requirements apply to relay nodes and the minimum requirement shall be as defined in clause 7.8.1 of TS 36.116 [2].

7.8.2 Access Link Receiver Intermodulation

The test requirements for the relay access link receiver intermodulation shall be the same as in clause 7.8 of TS 36.141 [3] except that the requirements apply to relay nodes. For the test requirements, only those for local area of clause 7.8 of TS 36.141 [3] shall apply.

8. Access Performance requirement

8.1 General

Access performance requirements are specified for a number of test environments and multipath channel classes and unless specified otherwise shall meet the performance requirements defined in clause 8 of TS 36.104 [4].

Unless stated otherwise, access performance requirements apply for a single carrier only. Performance requirements for a relay supporting carrier aggregation are defined in terms of single carrier requirements. The requirements only apply to those measurement channels that are supported by the base station.

The performance requirements for High Speed Train conditions defined in Annex B.3 of [3] are optional.

The performance requirements for UL timing adjustment scenario 2 defined in Annex B.4 of [3] are optional.

For BS with receiver antenna diversity the required SNR shall be applied separately at each antenna port.

In tests performed with signal generators a synchronization signal may be provided, from the base station to the signal generator, to enable correct timing of the wanted signal.

For tests in clause 8 the transmitter may be off.

8.2 Performance requirements for PUSCH

8.2.1 Requirements in multipath fading propagation conditions

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

The PUSCH performance requirements in multipath fading propagation conditions are the same as defined in TS 36.104 [4].

The test purpose, test method and test requirement in multipath fading propagation conditions are the same as defined in TS 36.141 [3].

8.2.2 Requirements for UL timing adjustment

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay.

The minimum requirements for UL timing adjustment are the same as defined in TS 36.104 [4]

The test purpose, test method and test requirement for UL timing adjustment are the same as defined in TS 36.141 [3].

8.2.3 Requirements for HARQ-ACK multiplexed on PUSCH

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The minimum performance requirements for HARQ-ACK multiplexed on PUSCH are the same as defined in TS 36.104 [3].

The test purpose, test method and test requirement for HARQ-ACK multiplexed on PUSCH are the same as defined in TS 36.141 [3].

8.3 Performance requirements for PUCCH

8.3.1 ACK missed detection requirements for single user PUCCH format 1a

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz or ETU 300Hz are optional.

The minimum requirements for DTX to ACK performance and for ACK missed detection are as defined in TS36.104 [4].

The test purpose, test method and test requirement for PUCCH format 1a are the same as defined in TS 36.141 [3].

8.3.2 CQI missed detection requirements for PUCCH format2

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The CQI missed detection requirements for PUCCH format 2 are the same as defined in TS 36.104 [4].

The test purpose, test method and test requirement for PUCCH format 2 are the same as defined in TS 36.141 [3].

8.3.3 ACK missed detection requirements for multi user PUCCH format 1a

The requirements for multi user PUCCH format 1a are optional. The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay.

The ACK missed detection requirements for multi user PUCCH format 1a are optional and are the same as defined in TS 36.104 [4].

The test purpose, test method and test requirement for multi user PUCCH format 1a are the same as defined in TS 36.141 [3].

8.4 Performance requirements for PRACH

8.4.1 PRACH false alarm probability and missed detection

The definition and applicability is the same as defined in TS 36.141 [3] except that the conformance test is applied for a relay. The requirements associated with ETU 70Hz are optional.

The minimum requirements for PRACH False alarm probability are the same as defined in TS 36.104 [4].

The test purpose, test method and test requirement for PRACH are the same as defined in TS 36.141 [3].

9. Backhaul Performance requirement

9.1 General

The performance requirements for the backhaul are based on relays that utilize a dual-antenna receiver.

For all test cases, the SNR is defined as:

$$SNR = \frac{\hat{E}_s^{(1)} + \hat{E}_s^{(2)}}{N_{oc}^{(1)} + N_{oc}^{(2)}}$$

where the superscript indicates the receiver antenna connector. The SNR is defined assuming resource elements (RE's) are not precoded, and the relative power of physical channels transmitted is defined in TS 36.101[2], Table C.3.2-1.

9.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

For the demodulation of PDSCH (cell-specific reference symbols), the test requirements are specified in clause 8.2 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.3 Demodulation of PDSCH (User-Specific Reference Symbols)

For the demodulation of PDSCH (user-specific reference symbols), the test requirements are specified in clause 8.3 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.4 Demodulation of PDCCH/PCFICH

For the demodulation of PDCCH/PCFICH, the test requirements are specified in clause 8.4 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.5 Demodulation of PHICH

For the demodulation of PHFICH, the test requirements are specified in clause 8.5 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.6 Demodulation of PBCH

For the demodulation of PBCH, the test requirements are specified in clause 8.6 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.7 Sustained downlink data rate provided by lower layers

For sustained downlink data rate provided by lower layers, the test requirements are specified in clause 8.7 of TS 36.521 [7], except that the requirements apply to relay nodes.

9.8 Demodulation of R-PDCCH

9.8.1 FDD

9.8.1.1 FDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration

9.8.1.1.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.1 of TR 36.826 [5] remains below a given reference value.

9.8.1.1.2 Test applicability

This test applies to all types of E-UTRA FDD relay node release 11 and forward.

9.8.1.1.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 9.8.1.1.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationFDD			10110101
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			1
CSI reference signal subframe configuration			I_{CSI-RS} = 37
N_{oc} at antenna port		dBm/15kHz	-98
Number of allocated resource blocks		PRB	2
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			No precoding
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms

NOTE 1: as specified in Table 5.4-1 in TS 36.216.
NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.
NOTE 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused.
NOTE 4: $n_{\mathrm{SCID}} = 0$

For the parameters specified in Table 9.8.1.1.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.1.1.3-2.

Table 9.8.1.1.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	R.1 FDD	Table B.2.1-1 of [5]	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1

9.8.1.1.4 Test description

9.8.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the RN needs to be tested in and the steps for the SS to take with the RN to reach the correct measurement state.

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [7], Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [8] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [8] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [8] clause 4.3.1.1:

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [8] Annex A, Figure A.9.

2. The parameter settings for the cell are set up according to Table 9.8.1.1.3-1.

3. The backhaul signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 defined in TS 36.521-1[7] and uplink signals according to Annex H.1 and H.3.2 defined in TS 36.521-1[7]. R-PDCCH is mapped to physical resources according to Table 9.8.1.1.3-1, Table 9.8.1.1.3-2 and Table B.1.1.1-1 of TR 36.826 [5]. The signals of R-PDCCH are initially set up according to Annex C.1 of TR 36.826 [5].

4. Propagation conditions are set according to Annex A clause A.1 of TR 36.826 [5].

5. Ensure the RN is in State 3A-RF according to TS 36.508 [8] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 9.8.1.1.4.3.

Table 9.8.1.1.4.1-1 RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [TS 36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

9.8.1.1.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 9.8.1.1.3-1 and Table 9.8.1.1.3-2.The details of R-PDCCH and PDSCH are specified in Table B.1.1.1-1 and R.3 FDD in Table C.2-1 respectively of TR 36.826 [5]. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 9.8.1.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1 [7]. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 9.8.1.1.5-1, pass the RN. Otherwise fail the RN.

9.8.1.1.4.3 Message contents

Message contents are according to TS 36.508 [8] clause 4.6 with the following exceptions

Table 9.8.1.1.4.3-1: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			
}			
}			
}			

Table 9.8.1.1.4.3-2: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not Checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 9.8.1.1.4.3-3: RN-SubframeConfig

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternFDD-r10	10110101		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0000 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
fdd SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not Checked		
}			
}			
}			
}			

Table 9.8.1.1.4.3-4: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

9.8.1.1.5 Test requirement

For the parameters specified in Table 9.8.1.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.1.1.5-1.

Table 9.8.1.1.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10MHz	R.1 FDD	Table B.2.1-1 of [5]	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	3.1

9.8.1.2 FDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration

9.8.1.2.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.1 of [5] remains below a given reference value.

9.8.1.2.2 Test applicability

This test applies to all types of E-UTRA FDD relay node release 11 and forward.

9.8.1.2.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 9.8.1.2.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 2
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationFDD			10110101
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0,1
CSI reference signal configuration			1
Number of CSI reference signals configured			4
CSI reference signal subframe configuration			I_{CSI-RS} = 37
N_{oc} at antenna port		dBm/15 kHz	-98
Number of allocated resource blocks		PRB	4
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon=1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms

NOTE 1: As specified in Table 5.4-1 in TS 36.216.
NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.
NOTE 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused.
NOTE 4: $n_{\mathrm{SCID}}=0$

For the parameters specified in Table 9.8.1.2.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.1.2.3-2.

Table 9.8.1.2.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10 MHz	R.2 FDD	Table B.2.1-1 of [5]	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

9.8.1.2.4 Test description

9.8.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the RN needs to be tested in and the steps for the SS to take with the RN to reach the correct measurement state.

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [7] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [8] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [8] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [8] clause 4.3.1.1:

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [8] Annex A, Figure A.11.
2. The parameter settings for the cell are set up according to Table 9.8.1.2.3-1.
3. The downlink signals are initially set up according to Annex C.1 and Annex C.3.2 of TR 36.826 [5] and uplink signals according to Annex H.1 and H.3.2 defined in TS 36.521-1[7].
4. Propagation conditions are set according to Annex A clause A.1 of TR 36.826 [5].
5. Ensure the RN is in State 3A-RF according to TS 36.508 [8] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 9.8.1.2.4.3.

Table 9.8.1.2.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [TS 36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

9.8.1.2.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 9.8.1.2.3-2.The details of R-PDCCH and PDSCH are specified in Table B1.1.1-1 of TR 36.826 [5] and R.4 FDD in Table C.2-1respectively. The SS sends downlink MAC padding bits on the DL RMC.
2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 9.8.1.2.5-1 as appropriate.
3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[7]. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 9.8.1.2.5-1, pass the UE. Otherwise fail the UE. If Pm-dsg is less than the value specified in table 9.8.1.2.5-1, pass the UE. Otherwise fail the UE.

9.8.1.2.4.3 Message contents

Message contents are according to TS 36.508 [8] clause 4.6 with the following exceptions.

Table 9.8.1.2.4.3-1: PhysicalConfigDedicated-DEFAULT

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
antennaInfo-r10 CHOICE {			
AntennaInfoDedicated-r10::= SEQUENCE {			
transmissionMode	tm9-v1020		
codebookSubsetRestriction-r10			
ue-TransmitAntennaSelection CHOICE {			
release	NULL		
}			
}			
}			
}			

Table 9.8.1.2.4.3-2: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 9.8.1.2.4.3-3: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 9.8.1.2.4.3-4: *RN-SubframeConfig*

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternFDD-r10	10110101		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	Type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0001 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
fdd SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not Checked		
}			
}			
}			
}			

Table 9.8.1.2.4.3-5: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

9.8.1.2.5 Test requirement

For the parameters specified in Table 9.8.1.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.1.2.5-1.

Table 9.8.1.2.4-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10 MHz	R.2 FDD	Table B.2.1-1 of [5]	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	12.5

9.8.2 TDD

9.8.2.1 TDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration

9.8.2.1.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 1x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.2 of TR 36.826 [5] remains below a given reference value.

9.8.2.1.2 Test applicability

This test applies to all types of E-UTRA TDD relay node release 11 and forward.

9.8.2.1.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 9.8.2.1.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 1
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationTDD			4
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			1
CSI reference signal subframe configuration			I_{CSI-RS} = 35
N_{oc} at antenna port		dBm/15 kHz	-98
Number of allocated resource blocks		PRB	2
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			No precoding
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms

NOTE 1: As specified in Table 5.4-1 in TS 36.216.
NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.
NOTE 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused.
NOTE 4: $n_{\mathrm{SCID}} = 0$

For the parameters specified in Table 9.8.2.1.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.2.1.3-2.

Table 9.8.2.1.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	R.1 TDD	Table B.2.1-1 of [5]	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	2.1

9.8.2.1.4 Test description

9.8.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the RN needs to be tested in and the steps for the SS to take with the RN to reach the correct measurement state.

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [7] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [8] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [8] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [8] clause 4.3.1.1:

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [8] Annex A, Figure A.9.

2. The parameter settings for the cell are set up according to Table 9.8.2.1.3-1.

3. The backhaul link downlink signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 of TR 36.826 [5] and uplink signals according to Annex H.1 and H.3.2 defined in TS 36.521-1[8]. R-PDCCH is mapped to physical resources according to Table 10.2.2.1.3-1, Table 10.2.2.1.3-2 and Table B.1.1.2-1. The signals of R-PDCCH are initially set up according to AnnexC.1 of TR 36.826 [5].

4. Propagation conditions are set according to Annex A clause A.1 of TR 36.826 [5].

5. Ensure the RN is in State 3A-RF according to TS 36.508 [8] clause 5.2A.2 with the following exception. Message contents are defined in clause 9.8.2.1.4.3.

Table 9.8.2.1.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

9.8.2.1.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 9.8.2.1.3-1 and 9.8.2.1.3-2.The details of R-PDCCH and PDSCH are specified in Table B1.1.2-1 of TR 36.826 [5] and R.3 TDD in Table C.2-2 of TR 36.826 [5] respectively. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 9.8.2.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[7]. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 9.8.2.1.5-1, pass the RN. Otherwise fail the RN.

9.8.2.1.4.3 Message contents

Message contents are according to TS 36.508 [8] clause 4.6 with the following exceptions.

Table 9.8.2.1.4.3-1: *RRCConnectionSetupComplete*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 9.8.2.1.4.3-2: *RNReconfiguration*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 9.8.2.1.4.3-3: *RN-SubframeConfig*

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternTDD-r10	4		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10			
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0000 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
tdd choice{			
fallbackForFormat3 SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not checked		
}			
}			
}			
}			
}			

Table 9.8.2.1.4.3-4: *RNReconfigurationComplete*

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

9.8.2.1.5 Test requirement

For the parameters specified in Table 9.8.2.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.2.1.5-1.

Table 9.8.2.1.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
1	10 MHz	R.1 TDD	Table B.2.1-1 of [5]	2 PRB	Format 2C	LOS with strong dominant component	1x2	1	3.1

9.8.2.2 TDD R-PDCCH performance based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration

9.8.2.2.1 Test purpose

This test verifies the demodulation performance of R-PDCCH when R-PDCCH is based on UE-specific reference signals transmitted on antenna port 7 with 4x2 antenna configuration. With a given SNR, the average probability of miss-detection of the Downlink Scheduling Grant for RN, tested on R-PDCCH of the specified reference measurement channels in B.1.1.2 remains below a given reference value.

9.8.2.2.2 Test applicability

This test applies to all types of E-UTRA TDD relay node release 11 and forward.

9.8.2.2.3 Minimum conformance requirements

The receiver characteristics of the R-PDCCH are determined by the probability of miss-detection of the relay Downlink Scheduling Grant (Pm-dsg).

Table 9.8.2.2.3-1: Test Parameters for single-layer transmission on port 7 of R-PDCCH

Parameter		Unit	Test 2
Cyclic prefix			Normal
Cell ID			0
Un subframe type in DeNB			Normal subframe
SubframeConfigurationTDD			4
Number of OFDM symbols for PDCCH		OFDM symbols	2
Configuration of OFDM symbols for eNB-to-RN transmission in the first slot			2 (Note 1)
Downlink power allocation	R-PDCCH_RA	dB	0
	R-PDCCH_RB	dB	0
Cell-specific reference symbols			Antenna port 0
CSI reference signal configuration			1
Number of CSI reference signals configured			4
CSI reference signal subframe configuration			I_{CSI-RS} = 35
N_{oc} at antenna port		dBm/15 kHz	-98
Number of allocated resource blocks		PRB	4
Symbols for unused PRBs			OCNG (Note 2)
Simultaneous transmission (Note 3)			No
Beamforming Model			a precoder vector $W(i)$ of size 4×1 is randomly selected with the number of layers $\upsilon=1$ from Table 6.3.4.2.3-2 in TS 36.211 as beamforming weights
Precoder update granularity			Frequency domain: 1 PRG Time domain: 1 ms

NOTE 1: As specified in Table 5.4-1 in TS 36.216.
NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.
NOTE 3: The modulation symbols of the signal under test are mapped onto antenna port 7 while antenna port 8 is unused.
NOTE 4: $n_{\mathrm{SCID}}=0$

For the parameters specified in Table 9.8.2.2.3-1 the average probability of a missed relay downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.2.2.3-2.

Table 9.8.2.2.3-2: Minimum performance for R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10MHz	R.2 TDD	B.2.2-1 of [5]	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	11.5

9.8.2.2.4 Test description

9.8.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the RN needs to be tested in and the steps for the SS to take with the RN to reach the correct measurement state.

Configurations of PDSCH and PDCCH before measurement are specified in TS 36.521-1 [7] Annex C.2.

Test Environment: Normal, as defined in TS 36.508 [8] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 36.508 [8] clause 4.3.1.1.

Channel Bandwidths to be tested: 10MHz, as defined in TS 36.508 [8] clause 4.3.1.1:

1. Connect the SS, the faders and AWGN noise source to the RN antenna connector (s) as shown in TS 36.508 [8] Annex A, Figure A.11.

2. The parameter settings for the cell are set up according to Table 9.8.2.2.3-1.

3. The backhaul link downlink signals except for R-PDCCH are initially set up according to Annex C.1 and Annex C.3.2 of TR 36.826 [5] and uplink signals according to Annex H.1 and H.3.2 defined in TS36.521-1[7]. R-PDCCH is mapped to physical resources according to Table 10.2.2.2.3-1, Table 10.2.2.2.3-2 and Table B.1.1.2-1. The signals of R-PDCCH are initially set up according to AnnexC.1.

4. Propagation conditions are set according to Annex A clause A.1 of TR 36.826 [5].

5. Ensure the RN is in State 3A-RF according to TS 36.508 [8] clause 5.2A.2 with the following exceptions. Message contents are defined in clause 9.8.2.2.4.3.

Table 9.8.2.2.4.1-1: RN registration with test mode activation procedure (state 1 to state 2A)

Step	Procedure	Message Sequence	
		R - S	Message
1 to 17	Same procedure for steps 1 to 17 as specified in the procedure in Table 4.5.2A.3-1 [36.508]		
18	The SS transmits an *RNReconfiguration message to configurate the backhaul link*	<--	RRC: *RNReconfiguration*
19	The RN transmits an *RNReconfigurationComplete message to comfirm the configuration of backhal link*	-->	RRC: *RNReconfigurationComplete*
20	This message includes the ATTACH COMPLETE message. The ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message is piggybacked in ATTACH COMPLETE.	-->	RRC: *ULInformationTransfer* NAS: ATTACH COMPLETE NAS: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT
21	The SS transmits an *RRCConnectionRelease* message to release RRC connection and move to RRC_IDLE (State 2A).	<--	RRC: *RRCConnectionRelease*

9.8.2.2.4.2 Test procedure

1. SS transmits PDSCH via R-PDCCH DCI format 2C for C_RNTI to transmit the DL RMC according to Table 9.8.2.2.3-1 and 9.8.2.2.3-2.The details of R-PDCCH and PDSCH are specified in Table B1.1.2-1 of TR 36.826 [5] and R.4 TDD in Table C.2-2 of TR 36.826 [5] respectively. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 9.8.2.2.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.4 defined in TS 36.521-1[7]. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 9.8.2.2.5-1, pass the RN. Otherwise fail the RN

9.8.2.2.4.3 Message contents

Message contents are according to TS 36.508 [8] clause 4.6 with the following exceptions.

Table 9.8.2.2.4.3-1: PhysicalConfigDedicated-DEFAULT

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
antennaInfo-r10 CHOICE {			
AntennaInfoDedicated-r10::= SEQUENCE {			
transmissionMode	tm9-v1020		
codebookSubsetRestriction-r10			
ue-TransmitAntennaSelection CHOICE {			
release	NULL		
}			
}			
}			
}			

Table 9.8.2.2.4.3-2: RRCConnectionSetupComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RRCConnectionSetupComplete ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE {			
rrcConnectionSetupComplete-r8 SEQUENCE {			
selectedPLMN-Identity	1		
registeredMME	Not checked		
dedicatedInfoNAS	Present but contents not checked		
nonCriticalExtension SEQUENCE {			
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE {			
gummei-Type-r10	native		
rlf-InfoAvailable-r10	true		
logMeasAvailable-r10	true		
rn-SubframeConfigReq-r10	required		
nonCriticalExtension SEQUENCE{}	No checked		
}			
}			
}			
}			
}			
}			

Table 9.8.2.2.4.3-3: RNReconfiguration

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfiguration ::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-DL		
criticalExtensions CHOICE {			
c1 CHOISE {			
RnReconfiguration-r10 SEQUENCE{			
rn-SystemInfo-r10{}	Not checked		
rn-SubframeConfig-r10	RN-SubframeConfig-r10		
lateNonCriticalExtension	Not checked		
nonCriticalExtension SEQUENCE{}	Not checked		
}			
}			
}			

Table 9.8.2.2.4.3-4: RN-SubframeConfig

Derivation Path: 36.331 clause 6.3.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RN-SubframeConfig-r10::= SEQUENCE {			
subframeConfigPattern-r10 CHOICE{			
subframeConfigPatternTDD-r10	4		
}			
rpdcch-Config-r10 SEQUENCE{			
resourceAllocationType-r10	type0		
resourceBlockAssignment-r10 CHOICE{			
type01-r10 SEQUENCE{			
nrb50-r10	0000 0001 1000 0000 0		
}			
}			
demodulationRS-r10 CHOICE{			
noInterleaving-r10	dmrs		
}			
pdsch-Start-r10	3		
pucch-Config-r10 CHOICE{			
tdd choice{			
fallbackForFormat3 SEQUENCE{			
n1PUCCH-AN-P0-r10	0		
n1PUCCH-AN-P1-r10	Not Checked		
}			
}			
}			
}			
}			

Table 9.8.2.2.4.3-5: RNReconfigurationComplete

Derivation Path: 36.331 clause 6.2.2			
Information Element	**Value/remark**	**Comment**	**Condition**
RNReconfigurationComplete::= SEQUENCE {			
rrc-TransactionIdentifier	RRC-TransactionIdentifier-UL		
criticalExtensions CHOICE {			
c1 CHOICE{			
rnReconfigurationComplete-r10 SEQUENCE{			
lateNonCriticalExtension	Not checked		
nonCriticalExtension	Not checked		
}			
}			
criticalExtensionsFuture SEQUENCE{}	Not checked		
}			
}			

9.8.2.2.5 Test requirement

For the parameters specified in Table 9.8.2.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 9.8.2.2.5-1.

Table 9.8.2.2.5-1: Test requirement R-PDCCH without cross-interleaving (FRC)

Test number	Bandwidth	Reference channel	OCNG Pattern	Aggregation level	DCI format	Propagation Condition	Antenna configuration and correlation Matrix	Reference value	
								Pm-dsg (%)	SNR (dB)
2	10 MHz	R.2 TDD	B.2.2-1 of [5]	4 PRB	Format 2C	NLOS with medium correlation	4x2	1	12.5

Annex A (normative): Propagation models for relay demodulation requirements

A.1 Propagation models for backhaul link

A.1.1 Delay Profiles

Three representative delay profiles are selected corresponding to the LOS and NLOS scenarios.

A.1.1.1 LOS between eNB and relay

Table A.1.1-1 and Table A.1.1-2 show the delay profiles for the LOS scenarios: one with strong dominant component and the other with medium dominant component. Note that the first tap in both Table A.1.1-1 and Table A.1.1-2 corresponds to the LOS component, it is therefore a non-fading tap and the corresponding Doppler frequency is 0.

Table A.1.1-1: Delay Profile for LOS Scenario (strong dominant component)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-21.0
70	-22.0
90	-23.0

Note that as the first tap is at least 21dB stronger than the rest taps, this channel may be considered as an AWGN channel. The exact one-tap static AWGN channel model is FFS.

Table A.1.1-2: Delay Profile for LOS Scenario (medium dominant component)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-11.0
70	-12.0
90	-13.0
110	-18.0
190	-27.2
[410]	[-30.8]

Note that as the first tap is at least 11dB stronger than the rest taps, this channel may be characterized by one dominant path combined with significant scattering paths.

A.1.1.2 NLOS between eNB and relay

For NLOS scenario, the delay profile is given in Table A.1.1-3.

Table A.1.1-3: Delay Profile for NLOS Scenario

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

A.1.2 Doppler Frequency

For NLOS between the eNB and the relay, as the relay nodes are often fixed, hence a low Doppler frequency of 2Hz is used. Note that this 2 Hz Doppler frequency is only used for the new channels (such as R-PDCCH).

A.1.3 MIMO Correlation Matrices

For LOS component between the eNB and the relay, the spatial channel correlation matrix is modeled as an all one matrix unless cross-polarized antennas are deployed. This is because the correlation matrix for the channel with single LOS component is of rank 1.

For NLOS scenario, the correlation matrices are given in the following tables.

Table A.1.3-1 defines the correlation matrices for the eNB:

Table A.1.3-1: eNB correlation matrix

	One antenna	Two antennas	Four antennas
eNB Correlation	$R_{eNB} = 1$	$R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & \mathbf{1} \end{pmatrix}$	$R_{eNB} = \begin{pmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9*} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9*} & \alpha^{1/9*} & 1 & \alpha^{1/9} \\ \alpha^* & \alpha^{4/9*} & \alpha^{1/9*} & 1 \end{pmatrix}$

Table A.1.3-2 defines the correlation matrices for the relay:

Table A.1.3-2: Relay correlation matrix

	One antenna	Two antennas	Four antennas
Relay Correlation	$R_{\mathrm{Re}lay} = 1$	$R_{\mathrm{Re}lay} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$	$R_{\mathrm{Re}lay} = \begin{pmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9*} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9*} & \beta^{1/9*} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9*} & \beta^{1/9*} & 1 \end{pmatrix}$

The values of α and β for different correlation types are given in Table A.1.3-3.

Table A.1.3-3: Low, Medium and High Correlation Values

Low correlation		Medium Correlation		High Correlation	
α	β	α	β	α	β
0	0	0.3	0.9	0.9	0.9

For the channel from the eNB to the relay, the channel spatial correlation matrix R_{spat} is then given as the Kronecker product of the eNB correlation matrix and the relay correlation matrix, i.e. $R_{spat} = R_{eNB} \otimes R_{\mathrm{Re}lay}$.

A.2 multipath propagation fading conditions for access link

Tables A.2-1 to Table A.2-3 show multi-path delay profiles that are used for the performance measurements in multi-path fading environment. All taps have classical Doppler spectrum, defined as:

(CLASS) $S(f) \propto 1/(1-(f/f_D)^2)^{0.5}$ for $f \in -f_D, f_D$.

Table A.2-1: Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

Table A.2-2: Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table A.2-3: Extended Typical Urban model (ETU)

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

A multipath fading propagation condition is defined by a combination of a multi-path delay profile and a maximum Doppler frequency f_D which is either 5, 70 or 300 Hz.

Note that the ETU model shown in Table A.2-3 and Doppler frequency of 300Hz are optional for relay access link demodulation requirments.

The relay access link demodulation requirements are the same or subset of the eNB requirements as described in TS 36.104.

Annex B (normative): Reference Measurement Channel

B.1 Reference measurement channels for R-PDCCH performance requirements

B.1.1 R-PDCCH format without cross-interleaving

B.1.1.1 FDD

Table B.1.1.1-1: Fixed Reference Channel for R-PDCCH transmitted on single-layer antenna port 7

Parameter	Unit	Value	
Reference channel		R.1 FDD	R.2 FDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated RB for R-PDCCH	RB	24, 25	23, 24, 25, 26
Aggregation level	PRB	2	4
DCI Format		Format 2C	Format 2C
Cell ID		0	0
Payload (without CRC)	Bits	42	42

B.1.1.2 TDD

Table B.1.1.2-1: Fixed Reference Channel for R-PDCCH transmitted on single-layer antenna port 7

Parameter	Unit	Value	
Reference channel		R.1 TDD	R.2 TDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated RB for R-PDCCH	RB	24, 25	23, 24, 25, 26
Aggregation level	PRB	2	4
DCI Format		Format 2C	Format 2C
Cell ID		0	0
Payload (without CRC)	Bits	45	45

B.2 OCNG patterns for R-PDCCH performance requirements

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference

symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i\_RA / OCNG\_RA = PDSCH_i\_RB / OCNG\_RB,$$

where γ_i denotes the relative power level of the i:th virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

B.2.1 FDD

B.2.1.1 OCNG FDD pattern 1for R-PDCCH

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous (divided in two parts by the allocated area – two sided) or continuous (one sided) in the frequency domain, starts with PRB 0 and ends with PRB N_{RB}-1.

Table B.2.1-1: OCNG for FDD R-PDCCH

Relative power level γ_{PRB} [dB]					**PDSCH Data**
Subframe					
Allocated subframes for R-PDCCH		**Subframes unallocated for R-PDCCH**			
The 1st slot	**The 2nd slot**	**0**	**5**	**Other subframes**	
Allocation					
0 – (First allocated PRB-1) and (Last allocated PRB+1) – (N_{RB}-1)	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	
0	0	0	0	0	Note 1

NOTE 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

NOTE 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in clause 7.1 in 3GPP TS 36.213.

B.2.2 TDD

B.2.2.1 OCNG TDD pattern 1for R-PDCCH

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous (divided in two parts by the allocated area – two sided) or continuous (one sided) in the frequency domain, starts with PRB 0 and ends with PRB N_{RB} -1.

Table B.2.2-1: OCNG for TDD R-PDCCH

Relative power level γ_{PRB} [dB]						**PDSCH Data**
Subframe (only if available for DL [Note 2])						
Allocated subframes for R-PDCCH		**Subframes unallocated for R-PDCCH**				
The 1st slot	**The 2nd slot**	**0**	**5**	**1 and 6 (as special subframes)**	**Other normal subframes**	
Allocation						
0 – (First allocated PRB-1) and (Last allocated PRB+1) – (N_{RB}-1)	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	First unallocated PRB – Last unallocated PRB	
0	0	0	0	0	0	Note 1

NOTE 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

NOTE 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211.

NOTE 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in clause 7.1 in 3GPP TS 36.213.

Annex C (normative): Physical Channel Set-up for conformance tests

C.1 Set-up for R-PDCCH

Table C.1-1 is applicable for demodulation performance requirements in which uniform RS-to-EPRE boosting for R-PDCCH.

Table C.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio	Note
R-PDCCH	R-PDCCH_RA = ρ_A	
	R-PDCCH_RB = ρ_B	
PDSCH	PDSCH_RA = ρ_A	
	PDSCH_RB = ρ_B	

NOTE 1: $\rho_A = \rho_B$ = 0 dB means no RS boosting.

NOTE 2: ρ_A denotes the ratio of PDSCH EPRE to cell-specific RS EPRE among PDSCH REs in all the OFDM symbols not containing cell-specific RS. ρ_B denotes the ratio of PDSCH EPRE to cell-specific RS EPRE among PDSCH REs in all the OFDM symbols containing cell-specific RS.

The power allocation for OFDM symbols and reference signals is the same as defined in Annex C.3.2 in TS 36.521-1 [7].

The PDCCH aggregation level for R-PDCCH demodulation tests is 8 CCE-s.

C.2 Set-up for PDSCH

Table C.2-1: PDSCH Reference Channel FDD for R-PDCCH test

Parameter	Unit	Value	
Reference channel		R.3 FDD	R.4 FDD
Number of transmitter antennas		1	4
Channel bandwidth	MHz	10	10
Allocated Resource Blocks		24 (Note 2)	21 (Note 3)
Modulation		QPSK	QPSK
Target Coding Rate		1/3	1/3
Information Bit Payload		2088	
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2088	1480
For Sub-Frame 5		n/a	n/a
For Sub-Frame0	Bits	n/a	n/a
Number of Code Blocks per Sub-Frame			
For Sub-Frames 1,2,3,4,6,7,8,9		1	1
For Sub-Frame 5		n/a	n/a
For Sub-Frame 0		n/a	n/a
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	6048	5040
For Sub-Frame 5	Bits	n/a	n/a
For Sub-Frame 0		n/a	n/a
NOTE 1: 2 symbols allocated to PDCCH for all BW, and DMRS port 7 is used. NOTE 2: PRB #0 to RPB #23 is allocated for PDSCH transmission. NOTE 3: PRB #0 to RPB #20 is allocated for PDSCH transmission.			

Table C.2-2: PDSCH Reference Channel TDD for R-PDCCH test

Parameter	Unit	Value		
Reference channel		R.3 TDD	R.4 TDD	
Number of transmitter antennas		1	4	
Channel bandwidth	MHz	10	10	
Uplink-Downlink Configuration (Note 2)		1	1	
Special subframe configuration(Note 3)		4	4	
Allocated Resource Blocks		24 (Note 4)	21 (Note 5)	
Modulation		QPSK	QPSK	
Target Coding Rate		1/3	1/3	
Information Bit Payload				
For Sub-Frame 4,9		2088	1480	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
Number of Code Blocks per Sub-Frame				
For Sub-Frame 4,9	Bits	1	1	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
Binary Channel Bits Per Sub-Frame				
For Sub-Frame 4,9	Bits	6048	5040	
For Sub-Frame 1,6	Bits	n/a	n/a	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	n/a	n/a	
NOTE 1: 2 symbols allocated to PDCCH for all BW, and DMRS port 7 is used. NOTE 2: As per Table 4.2-2 in TS 36.211. NOTE 3: As specified in Table 4.2-1 in TS 36.211. NOTE 4: PRB #0 to RPB #23 is allocated for PDSCH transmission. NOTE 5: PRB #0 to RPB #20 is allocated for PDSCH transmission.				

Annex D (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2012-10	RAN4#64bis	R4-125715			Skeleton TS for Relay Conformance Testing		0.0.1
2012-11	RAN4#65	R4-126627			Added sections 8.0 Access Performance Requirements; and 9.8 Demodulation of R-PDCCH	0.0.1	0.1.0
2012-11	RAN4#66	R4-126634			Updated Sections 2 on References; section 3 on Definitions, symbols, and abbreviations; section 4 on General test conditions and declarations; and section 5 on Operating bands and channel arrangement;	0.1.0	0.2.0
2013-04	RAN4#66bis	R4-130540			Updated section 4.7 on interpretation of tests	0.2.0	0.3.0
2013-04	RAN4#66bis	R4-130540			Updated section 6 on transmitter characteristics	0.2.0	0.3.0
2013-04	RAN4#66bis	R4-130544			Updated section 7 on receiver characteristics	0.2.0	0.3.0
2013-04	RAN4#66bis	R4-130552			Updated section 9 on backhaul performance requirements	0.2.0	0.3.0
2013-04	RAN4#66bis	R4-125893, R4-126297, R4-126806, R4-130233			Updated section 9.8.2 on TDD backhaul link test requirements	0.2.0	0.3.0
2013-05	RAN4#67	R4-131184			Updated backhaul link conformance tests to be consistent with changes in CR 007 for TR 36.826	0.3.0	0.4.0
2013-05	RAN4#67	R4-131569			Updates MCL in section 6.2 and minimum output power in section 6.3.2 for the backhaul link test requirements	0.3.0	0.4.0
2013-05	RAN4#67				Editorial corrections and reference corrections and additions	0.3.0	0.4.0
2013-05	RAN4#67				Updated TOC	0.3.0	0.4.0
2013-05	RAN4#67	R4132368			Corrections to unwanted emissions tests in section 6.5.3	0.4.0	1.0.0
2013-05	RAN4#67	R4-132363			Corrections to output power tests in section 6.2.5	0.4.0	1.0.0
2013-05	RAN4#67	R4-132979			Corrections to blocking for co-location requirements in section 7.6.3	0.4.0	1.0.0
2013-05	RAN4#67	R4132945			Correction to backhaul configuration tests in section 9.8	0.4.0	1.0.0
2013-05	RP-60	RP-130648			TR Approved by RAN	1.0.0	11.0.0
2013-09					Editorial Correction of the version in the change history table	11.0.0	11.0.1
2013-09	RP-61	RP-131285	0001		CR on TS 36.117 Section 7.7.1: Backhaul Link Receiver Spurious Emissions	11.0.1	11.1.0
2014-09	SP-65	-	-	-	Update to Rel-12 version (MCC)	11.1.0	12.0.0

History

Document history		
V12.0.0	October 2014	Publication